



# Android based Hearing Aid with Gestures

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**Abstract:** A mediator person is required for communication between deaf person and a second person. But a mediator should know the sign language used by deaf person. But this is also not possible always since there are multiple sign languages for multiple languages. It is difficult for a deaf person to understand what a second person speaks. And therefore, deaf person should keep track of lip movements of second person in order to know what he is speaking. But the lip movements do not give proper efficiency and accuracy since the facial expressions and speech might not match. To overcome the above problems, we have proposed a system, an Android Application for recognizing sign language using hand gesture. The features of this system are the real time conversion of gesture to text and speech. For two-way communication between deaf person and second person, the speech of second person is converted into text. The processing steps include: gesture extraction, gesture matching and conversion of text to speech and vice-versa. The system is not only useful for deaf community but can also be used by common people who migrate to different regions and do not know local language.

## I. INTRODUCTION

Android based hearing aid is an android type mobile messaging application designed and developed for the thorough communication between two disabled people most especially the hearing-impaired and blind people. With stable and smart Eclipse IDE and the availability of different built-in libraries in java especially the tts.speech. Speech To Text and tts.speech. Recognizer Intent has been taken advantage to create custom voice command functionalities. Creating, replying, sending and forwarding messages are among the primary and fundamental features that this study has to offer. The researchers analyzed the results of the test survey and evaluation form and proved that the application is a user friendly, efficient and accurate in delivering messages to the recipient and has the important features that the users expected.

A Deaf person is very much dependent on the sign language to communicate with the other person. So the person who is interacting with the deaf person needs to know the sign language in order to understand and communicate effectively. Since many people are not familiar with sign language, it very difficult for a deaf person to have interaction with the society. The previously implemented system had a predefined database with a limited scope. Thus, we are facilitating an application that will allow a user to define their own database i.e. to define and upload his own sign language in the system. This feature will help deaf people to communicate with other people varying from different countries or regions. A Mobile Application of American Sign Language Translation via Image Processing Algorithms Cheok Ming Jin, Zaid Omar Faculty of Electrical Engineering Universiti Teknologi Malaysia 81310 Skudai, Malaysia Mohamed Hisham Jaward School of Engineering Monash University Malaysia 47500 Bandar Sunway, Malaysia Abstract— Due to the relative lack of pervasive sign language usage within our society, deaf and other verbally-challenged people tend to face difficulty in communicating on a daily basis. Our study thus aims to provide research into a sign language translator applied on the smartphone platform, due to its portability and ease of use. In this paper, a novel framework comprising established image processing techniques is proposed to recognise images of several sign language gestures. More specifically, we initially implement Canny edge detection and seeded region growing to segment the hand gesture from its background. Feature points are then extracted with Speeded Up Robust Features (SURF) algorithm, whose features are derived through Bag of Features (BoF). Support Vector Machine (SVM) is subsequently applied to classify our gesture image dataset; where the trained dataset is used to recognize future sign language gesture inputs. The proposed framework has been successfully implemented on smartphone platforms, and experimental results show that it is able to recognize and translate 16 different American Sign Language gestures with an overall accuracy of 97.13%. Keywords— Computer Vision, Gesture Recognition, Image Processing, Machine Learning, Sign Language .

Sign language is a form of hand gestures involving visual motions and signs, which are used as a system of communication notably by the deaf and verbally-challenged community. It is seldom however used by normal hearing people and few are able to understand sign language. This poses a genuine communication barrier between the deaf community and the rest of the society, as a problem yet to be fully solved. Modern research into sign language recognition can be categorised into contact-based and vision-based approaches. Contact-based approaches involves physical interaction between user and sensing devices . It typically uses



instrumented glove which utilizes electromyography, inertial measurement or electromagnetic to collect finger flexion, position, orientation or angle data of the sign performed. Vision-based approaches use data collected from images or video frames captured using camera as input of the system. It can be further divided into 3D model-based and appearance-based approaches. 3D model-based approaches generally attempt to infer the pose of palm and joint angle hand in 3D space into 2D projection. Whereas appearance-based uses regions. Features extracted from visual appearance of the images and recognition is done by comparing these features. Vision-based approach is often preferred over contact-based approaches as it often does not involve the wearing of instrumental gloves or other hardware besides camera to perform the recognition process. In some vision-based research however, coloured gloves are used to alleviate the hand segmentation process. The major challenges faced by visual based approach is that the accuracy is often affected by noises, lighting condition, variation of viewpoint and the presence of complex background. Sign language recognition in general involves a few phases of process namely the segmentation, feature extraction and classification. The main objective of the segmentation phase is to remove the background and noises, leaving only the Region of Interest (ROI), which is the only useful information in the image. In the feature extraction phase, the distinctive features of the ROI will be extracted. These features can be the curvatures, edges, shapes, corners, moments, textures, colours or others. In the context of sign language recognition, these features are essentially analogous to the identity of each sign language gesture. Next, the features extracted will undergo classification whereby the features of each gesture will be grouped accordingly, and this will be used as a database to match new sign language gesture inputs to which of the groups classified earlier do they belong.

## II. RELATED WORK

Communication can be defined as the process of transmitting information and common understanding from one person to another (Keyton, 2011).

Communication is an essential feature of humanity. It is the process of sharing our ideas, thoughts, concerns and feelings with other people and having those ideas, thoughts and feelings understood by the people whom we are talking with. Communication—the ability to convey information to others and the ability to receive and interpret information from others—is fundamental to learning. Individuals learn about the world mostly through their senses of vision and hearing. Vision and hearing are the main sensory avenues for accessing and interacting with the world around us and for perceiving events as close or distant. When vision and hearing are reduced, even to a mild level, the losses affect the ability to communicate, develop personal relationships, and acquire concepts (Riggio and McLetchie, 2008).

Globalization is one of the main words of the 21st century. We feel its presence in almost every field of our life: in economic, politics, culture and media (Kolosova, 2012). Accompanied by the rapid growth of information technology, android mobiles are now used widely in a variety of fields. Applications of mobile and various software in training, teaching, learning, and computer assisted instruction are a major future trend.

However, most applications are designed for normal people, and are inaccessible to those who are deaf, blind, deaf-blind and people living with disabilities, unless extra adaptive tools and interfaces were designed for them. Consequently, a current trend in high technology production is to develop adaptive tools for deaf and blind people to assist them with self-learning and personal development, and lead more independent lives (Aher, Musale, Pagar, & Morwal, 2014).

Traditionally, technology and other interventions designed for children with disabilities were focused on strategies aimed at correcting a child's specific impairment or deficit (Wise, 2012). Some of the notetakers can be used in face-to-face conversation of the blind and hearing-impaired person. The hearing-impaired person types the text in the keyboard and the blind reads the text through the braille display in the device. The blind can reply through typing in the Braille keyboard the text and read in the screen by the hearing-impaired person.

## III. PROPOSED SYSTEM

The proposed system is the enhanced application of the Deaf, Dumb and blind people. The advantages of the proposed system is,

- A. The application can be free of cost in the play store.
- B. Less Expensive in the sense that the less data will be used.
- C. Long distance communication can be done through the application.
- D. Where as the Short distance can be done in the absence of network in the smart phone through the Bluetooth.
- E. Main advantage is that it is Eco friendly and can be helpful to the handicapped people.

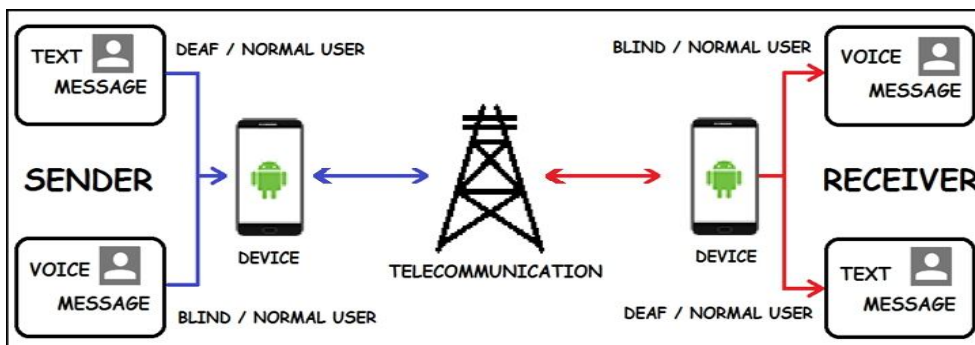


Figure: Architecture of the Proposed System

#### IV. IMPLEMENTATION

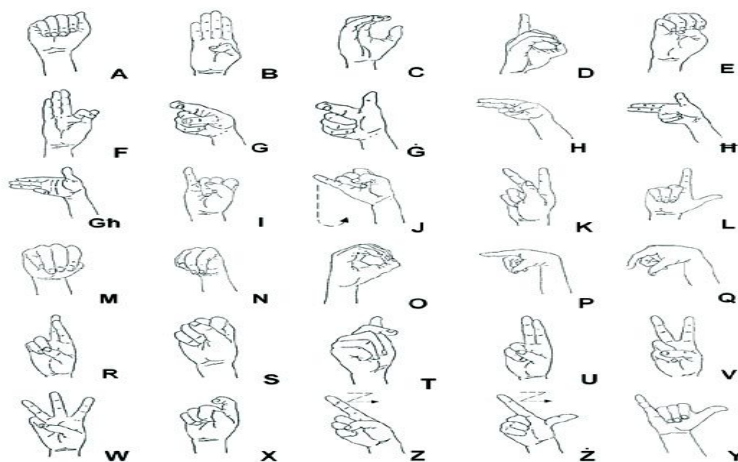
##### A. Text to Speech

This module is responsible to convert entered text to speech. User can give input as text and as output audio repeating the text can be heard. User will also get the option to set the pitch and the speed for the output audio. The speed can be controlled using the progress bar provided in the user interface. The mid-point of the progress bar represents the normal speed and if the progress bar is set right to mid then the speed will increase and if it is set to left of mid then speed will reduce. If the progress bar is set to the right most of side then the speed is maximum and if the progress bar is set to the left most side then the speed is minimum. Similarly, pitch of the audio can be controlled using the option provided in the user interface. The option is in the form of progress bar. The mid-point of the progress bar represents the normal speed and if the progress bar is set right to mid then the pitch of audio will increase and if it is set to left of mid then pitch of audio will reduce. If the progress bar is set to the right most side then the pitch is maximum and if the progress bar is set to the left most side then the pitch is minimum. Android allows you to convert your text into voice. Not only you can convert it but it also allows you to speak text in variety of different languages.

##### B. Speech to Text

This module will convert speech to text, the speech accepted as input should be in English. The application contains mic icon for converting speech to text. On pressing the mic icon voice recognition will be activated and one can speak and that will be recognised and converted to text. The text can be sent to other user via Bluetooth or online via internet. Android comes with an inbuilt feature speech to text through which you can provide speech input to your app. With this you can add some of the cool features to your app like adding voice navigation (Helpful when you are targeting disabled people), filling a form with voice input etc., In the background how voice input works is, the speech input will be streamed to a server, on the server voice will be converted to text and finally text will be sent back to our app. Public class SpeechRecognizer extends Object This class provides access to the speech recognition

##### C. Sign Language To Text





This module consists the functionality of detecting sign language and converting it to text. The module detects the ASL sign language and convert it to text format. Hand gesture is one of the method used in sign language for non-verbal communication. It is most commonly used by deaf & dumb people who have hearing or speech problems to communicate among themselves or with normal people. Various sign language systems has been developed by many makers around the world but they are neither flexible nor cost-effective for the end users. Hence in this project introduced software which presents a system prototype that is able to automatically recognize sign language to help deaf and dumb people to communicate more effectively with each other or normal people. Pattern recognition and Gesture recognition are the developing fields of research. Being a significant part in nonverbal communication hand gestures are playing key role in our daily life. Hand Gesture recognition system provides us an innovative, natural, user friendly way of communication with the android application which is more familiar to the human beings. By considering in mind the similarities of human hand shape with four fingers and one thumb, the application aims to present a real time system for recognition of hand gesture on basis of detection of some shape based features like orientation, Centre of mass centroid, fingers status, thumb in positions of raised or folded fingers of hand. The sign language is a very important way of communication for deaf-dumb people. In sign language each gesture has a specific meaning. So therefore complex meanings can be explain by the help of combination of various basic elements. Sign language is a gesture based language for communication of deaf and dumb people. It is basically a non-verbal language which is usually used to deaf and dumb people to communicate more effectively with each other or normal people. Sign language contains special rules and grammar's for expressing effectively.

Basically there are two main sign language recognition approaches image-based and sensor-based. But lots of research is going on image based approaches only because of advantage of not need to wear complex devices like Hand Gloves, Helmet etc. like in sensor based approach. Gesture recognition is gaining importance in many applications areas such as human interface, communication, multimedia and security. Typically Sign recognition is related as image understanding. It contains two phases: sign detection and sign recognition. Sign detection is an extracting feature of certain object with respect to certain parameters. Sign recognition is recognizing a certain shape that differentiates the object from the remaining shapes. Language, especially in the cases when no alternative communication is available. The technical point of view characteristic features of sign language communication are: its social direction and meaning; technical and technological convenience and easy to use. The system will use a camera for the focusing images and pre-processing of the signs will be done by using OpenCv library. On having the input sequence of images captured through camera here uses some image preprocessing steps for removal of background noise and employs slope distance based algorithm i.e. Fingertip Detection by convexity hull algorithm which generates a ratio with a help of which a template of the captured image is generated.

## V. RESULT AND FUTURE ENCHANCEMENT

### A. Result

The test results show that our Hearing-Aid application framework on top of Wi-Fi Direct works very well. We designed and implemented GSM and Wi-Fi for wireless control for binaural hearing aids that doesn't need to a wireless repeater system and remote-control system. The GSM helps the users in both ends to communicate and thus the both hearing-impaired persons in the both ends can communicate and talk without texting or requiring any other support. The design of smart hearing aid brings a cost effective and portable system into existence. In different ways, hearing aid is easy to use. We can easily enhance access to all functionality. This will make very sensitive to users. Not only the deaf, the people who lacking the power of hearing or having impaired hearing but it is also useful to dump peoples. Two deaf and dump peoples can easily communicate with each other's.

Reliable data transmission via ultra-high frequency signals. It's a thing that is *reliable* can be trusted to work well or to behave in the way that which provide good facility. No additional hardware required – just your smartphone. Also, we have added the sign languages on it which gives extra features for our project. As a whole, this project leads to good environment with deaf and dump peoples. Mostly it is very useful to communicate through online and design is so simple anyone can use it.

### B. Future Enhancement

The project 'Android based hearing-aid' has so many functionalities on it which can be easily used. For the future, we people of our project planned to add more sign languages. The WHO estimates that in 2012 there were 285 million visually impaired people in the world, of which 246 million had low vision and 39 million were blind. Of those who are blind 90% live in the developing world. As a survey it tells us, there are many people who can't see with their eyes. For the blind people also, we are thinking to develop the functionality which is needed for them. Adding all the sign languages will make our project even better. Not only the dump, deaf peoples as well as blind people can access functionality of android application. If we look into our future, it will not be useful after some years. So, the thing is that project will be even better if we add more sing languages on it.



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